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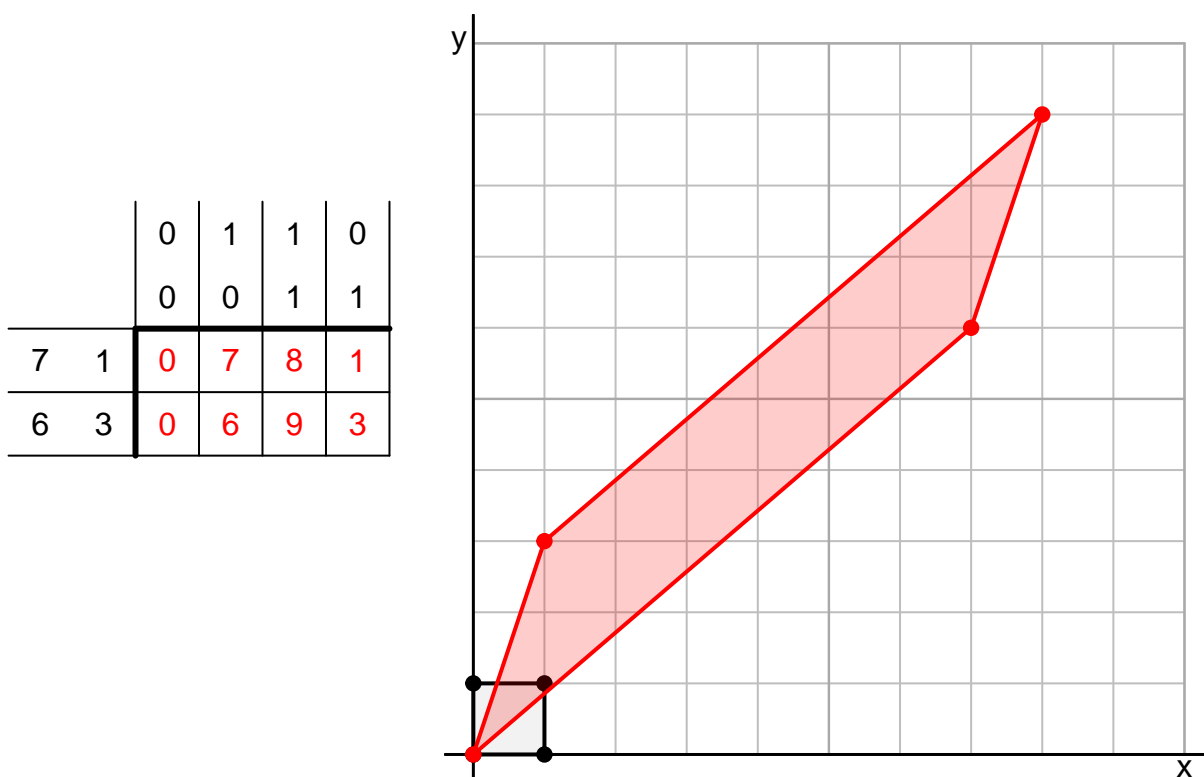
s19 Matrix Exam (solution v9)

Let the 2×4 matrix U represent four points in the xy -plane (so each column represents a point). When those four points are connected as a convex polygon, matrix U represents a unit square. Also, let the 2×2 matrix L represent a linear transformation.

$$U = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix} \quad L = \begin{bmatrix} 7 & 1 \\ 6 & 3 \end{bmatrix}$$

Let matrix $P = L \cdot U$, so P is found by matrix multiplication of L times U . Matrix P also represents 4 points of a polygon. Use the diagram below to calculate the elements of P . Then, draw the polygon represented by matrix P on the xy -plane below. Notice I have already drawn the unit square represented by matrix U .

1. Multiply $L \cdot U$ and draw resulting polygon.



2. What is the area of the convex polygon represented by matrix P ? *Hint: the area equals the absolute value of the determinant of matrix L .*

$$\text{area} = \det(L) = (7 \cdot 3) - (1 \cdot 6)$$

$$\text{area} = 15$$

The triangle shown below is composed of the three points represented by matrix $A = \begin{bmatrix} 5 & 0 & 10 \\ 0 & 10 & 0 \end{bmatrix}$. In order to reflect over the y axis and then rotate by 126.87° counterclockwise we can multiply by the transformation matrix $R = \begin{bmatrix} 0.6 & -0.8 \\ -0.8 & -0.6 \end{bmatrix}$.

3. Calculate the matrix $R \cdot A$.

$$R \cdot A = \begin{bmatrix} 3 & -8 & 6 \\ -4 & -6 & -8 \end{bmatrix}$$

4. Draw the triangle represented by $R \cdot A$.

